

INTERFACE REQUIREMENTS DOCUMENT
between the
EARTH OBSERVING SYSTEM DATA AND
INFORMATION SYSTEM
(EOSDIS)
and the
LANDSAT 7
SYSTEM

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

Interface Requirements Document
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Earth Observing System Data and Information System
(EOSDIS)
and the
LANDSAT 7
System

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GODDARD SPACE FLIGHT CENTER
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1. Introduction

1.1 Identification

This Interface Requirements Document (IRD) defines the interface requirements between ECS and the Landsat 7 System. This IRD, Contract Data Requirements List (CDRL) item 039, whose requirements are specified in Data Item Description (DID) 219/SE1, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000).

This document was previously submitted under document number 193-219-SE1-003.

1.2 Scope

This IRD defines all of the system interfaces that exist between ECS and the Landsat 7 System, including the Landsat Processing system (LPS), the Image Assessment System (IAS), the Mission Operations Center (MOC), the International Ground Stations (IGSs), and the Mission Management Office (MMO). Although the user interface is not discussed in detail, the products being distributed and the search capabilities are outlined. The ESDIS Project has joint responsibility with the Landsat Project for the development and maintenance of this IRD. Any changes in the interface requirements must be agreed to by the relevant participating parties, and then assessed at the ESDIS Project level. This IRD will be approved under the signature of the ESDIS Project Manager and will be under ESDIS Project configuration control.

1.3 Purpose and Objectives

This document was written to formalize the interpretation and general understanding of the interface between ECS and the Landsat 7 System. It is meant to stand alone as a total document and contains more detail than is provided in a Level 3 requirements specification.

The objective of this document is to provide a focus for defining the related Interface Control Document (ICD) which is jointly developed for the major subsystem interfaces identified in this IRD.

This document provides a point of mutual control of external interface definitions for the ESDIS CCB and the Landsat 7 Project CCB.

1.4 Status and Schedule

The purpose of this IRD is to document the interfaces between ECS and the Landsat 7 program required to support the Landsat 7 System.

This IRD was submitted as a Configuration Control Board (CCB) approval Code 1 document and is designated to be under full Government CCB control. Changes may be submitted for consideration by Contractor and Government CCBs under the normal change process at any time.

1.5 Document Organization

This IRD is organized as described below

Section 1	Introduction - Introduces the IRD's scope, purpose, objectives, status, schedule, and document organization.
Section 2	Related Documentation - Provides a bibliography of reference documents for the IRD organized by parent, applicable, and information subsections.
Section 3	Systems Description - Provides an overview of both systems and a discussion of the system components involved in the interface. A context diagram depicting the functional interfaces is also included.
Section 4	Data Flow Descriptions - Provides a discussion of how the interface is used from an operational point of view. A table is also provided to summarize the data flow interfaces.
Section 5	Functional and Performance Interface Requirements - Requirements are derived from supporting documentation and are sorted for presentation by denoting functional or performance type. Traceability to parent documents is also noted in this section.
Section 6	Interface Control Documentation Plan - Identifies and summarizes the ICD that will be derived from this IRD.

2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which this document's scope and content derive:

423-41-01	Goddard Space Flight Center, EOSDIS Core System Statement of Work, through CN-09
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System
430-L-0002-A	Goddard Space Flight Center, Landsat 7 System Specification
none	Goddard Space Flight Center, Inter-project Agreement between the Landsat Project and the Earth Data and Information System Project for the Landsat 7 System
193-208-SE1-001	Methodology for Definition of External Interfaces for the ECS Project

2.2 Applicable Documents

The following documents are directly applicable to the specification of the requirements in this document. In the event of conflict between any of these documents and this document, the conflict will be resolved by submitting Configuration Change Request to the appropriate CCBs.

194-201-SE1-001	Systems Engineering Plan for the ECS Project
301-CD-002-003	System Implementation Plan for the ECS Project

2.3 Information Documents

The following documents, although not directly applicable, amplify or clarify the information presented in this document. These documents are not binding on the content of this IRD.

194-604-OP1-001	ECS Operations Concept Document for the ECS Project
430-11-06-003-0	Goddard Space Flight Center, Landsat 7 System and Operations Concept

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3. Systems Descriptions

3.1 Systems Relationship Overview

The ECS and the Landsat 7 System will work together to provide user access, and data archive and product distribution functions for Landsat 7 data and information. Figure 3-1 depicts the functional interfaces between the ECS and the Landsat 7 System. Sections 3.2 and 3.3 provide overall views of the ECS and the Landsat 7 System to form a basis for understanding the interface requirements between them.

3.2 EOSDIS Core System (ECS)

3.2.1 ECS Overview

The ECS, the EOS Data and Operations System (EDOS), and the EOS Communications (Ecom) network are components of the EOSDIS. ECS supports the planning, scheduling, and control of U.S. EOS spacecraft and instruments. In addition to fully supporting the EOS mission, the ECS provides information management and data archive and distribution functions for NASA Earth science flight missions, NASA instruments flown on non-NASA spacecraft, and for other NASA-held Earth science data.

3.2.2 ECS Segments

ECS is composed of three segments defined to support three major operational areas: flight operations, science data processing, and communications/system management. The ECS segments are described below:

- a. The Flight Operations Segment (FOS) manages and controls the EOS spacecraft and instruments. The FOS includes the EOS Operations Center (EOC), which is responsible for mission planning, scheduling, control, monitoring, and data analysis in support of mission operations for U.S. EOS spacecraft and instruments. The ECS EOC is located at the Goddard Space Flight Center (GSFC). The FOS also provides investigator-site ECS software (the Instrument Support Terminal [IST] toolkit) to connect a Principal Investigator (PI) or Team Leader (TL) to the FOS in remote support of instrument control and monitoring. (Investigator facilities are outside the FOS, but connected to it by way of the EOSDIS Science Network [ESN] Wide Area Network [WAN].) The FOS has no interfaces with the Landsat 7 System.
- b. The Science Data Processing Segment (SDPS) provides a set of ingest, processing, and distribution services for science data and a data information system for the entire EOSDIS. The SDPS processes data from the EOS instruments to Level 1-4 data products. The SDPS also provides short- and long-term storage for EOS, other Earth observing missions including Landsat 7, and other related data, software, and results, and distributes

the data to EOSDIS users. The SDPS contains a distributed data and information management function and user services suite for the ECS, including a catalog system in support of user data selection and ordering, including user data selection and ordering for Landsat 7. SDPS elements will be distributed at the following Distributed Active Archive Centers (DAACs):

1. Goddard Space Flight Center (GSFC), Greenbelt, Maryland
2. Earth Resources Observation System (EROS) Data Center (EDC), Sioux Falls, South Dakota
3. Jet Propulsion Laboratory (JPL), Pasadena, California
4. Langley Research Center (LaRC), Hampton, Virginia
5. University of Colorado, National Snow and Ice Data Center (NSIDC), Boulder, Colorado
6. University of Alaska, Alaska Synthetic Aperture Radar (SAR) Facility (ASF), Fairbanks, Alaska¹
7. Marshall Space Flight Center (MSFC), Huntsville, Alabama
8. Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee^{1,3}
9. Socioeconomic Data and Applications Center (SEDAC), Saginaw, Michigan²

Notes: ¹These DAACs have no ECS-provided product generation capability.

²The ECS will provide no hardware or operations support to the SEDAC, but will make ECS software available for reuse.

³The ECS will provide hardware and ECS software to ORNL, but will not be responsible for operational support and hardware maintenance.

- c. The Communications and System Management Segment (CSMS) provides overall ECS management of ECS ground system resources, provides communications/networking services for an extensive science data communications network, and manages the interfaces to the Ecom network, the NASA Communications (Nascom) Local Area Network (NOLAN), and the NASA Science Internet (NSI). The CSMS also includes the ESN, which consists of a dedicated internal ECS Wide Area Network (WAN) with circuits provided by the Program Support Communications Network (PSCN); Local Area Networks (LANs) at each of the DAACs and the EOC to support ECS operations; connections to International Partners (IPs); and interfaces at DAACs with Ecom, NOLAN, and NSI. The CSMS System Management Center (SMC), along with local system management capabilities at DAAC sites and the EOC, provides system management services for ECS ground system resources. Most of the operations staff is considered part of the SDPS or FOS, including Local System Management (LSM) operators.

3.3 Landsat 7 System

3.3.1 Landsat 7 Overview

The Landsat 7 Program will provide a satellite remote sensing capability serving a broad community of users, including those involved in global change research as well as civil, national security, academic, and commercial applications. The Landsat 7 Program will continue the remote sensing capability currently provided by Landsats 4 and 5.

The Land Remote Sensing Policy Act of 1992 was signed into law by the President on October 28, 1992. This act repeals the Land Remote Sensing Commercialization Act of 1984, and requires the management responsibility of Landsat to be assumed by the government. Additionally, the 1992 act defines the "cost of fulfilling user request" to be the marginal cost to process and/or reproduce and distribute the data, thereby increasing the number of potential users and requests for Landsat data. The Landsat 7 data will be processed to a minimum product level by the Landsat 7 System. The goal of the Landsat 7 System is to acquire and periodically refresh global, substantially cloud free data of all sun-lit land masses.

The Landsat 7 satellite is scheduled for launch in 1998 and will be operational for a minimum of five years. The proposed satellite will perform multispectral imaging via the Enhanced Thematic Mapper Plus (ETM+). The ETM+ instrument provides data continuity with Thematic Mapper sensors on Landsats 4 and 5.

The Landsat 7 System is composed of a Space Segment, Launch Segment, Flight Operations Segment and Ground Data Handling Segment. These are described in more detail in section 3.3.2. The development of the Landsat 7 System will be managed by NASA with operations and maintenance being managed by NOAA. The Department of the Interior's (DOI) U.S. Geological Survey (USGS) will support the development of the Ground Data Handling Segment (GDHS) and will provide on-orbit operations and maintenance to the National Oceanic and Atmospheric Administration (NOAA) for the GDHS subsystems located at the EROS Data Center (EDC) a USGS facility near Sioux Falls South Dakota.

The Landsat 7 System development will be managed by the Landsat Project of the NASA GSFC. The Landsat Project is part of the EOS Program. Another project in the EOS Program is the ESDIS Project. Included in the development of EOSDIS will be Distributed Active Archive Centers (DAACs) throughout the United States to receive, process, archive, and distribute EOS data. An EOSDIS DAAC will be at the USGS's EROS Data Center (EDC). The ESDIS Project will utilize the functionality planned for EOSDIS to the maximum extent practical to provide commonalty between Landsat 7 and the other "Mission to Planet Earth" projects.

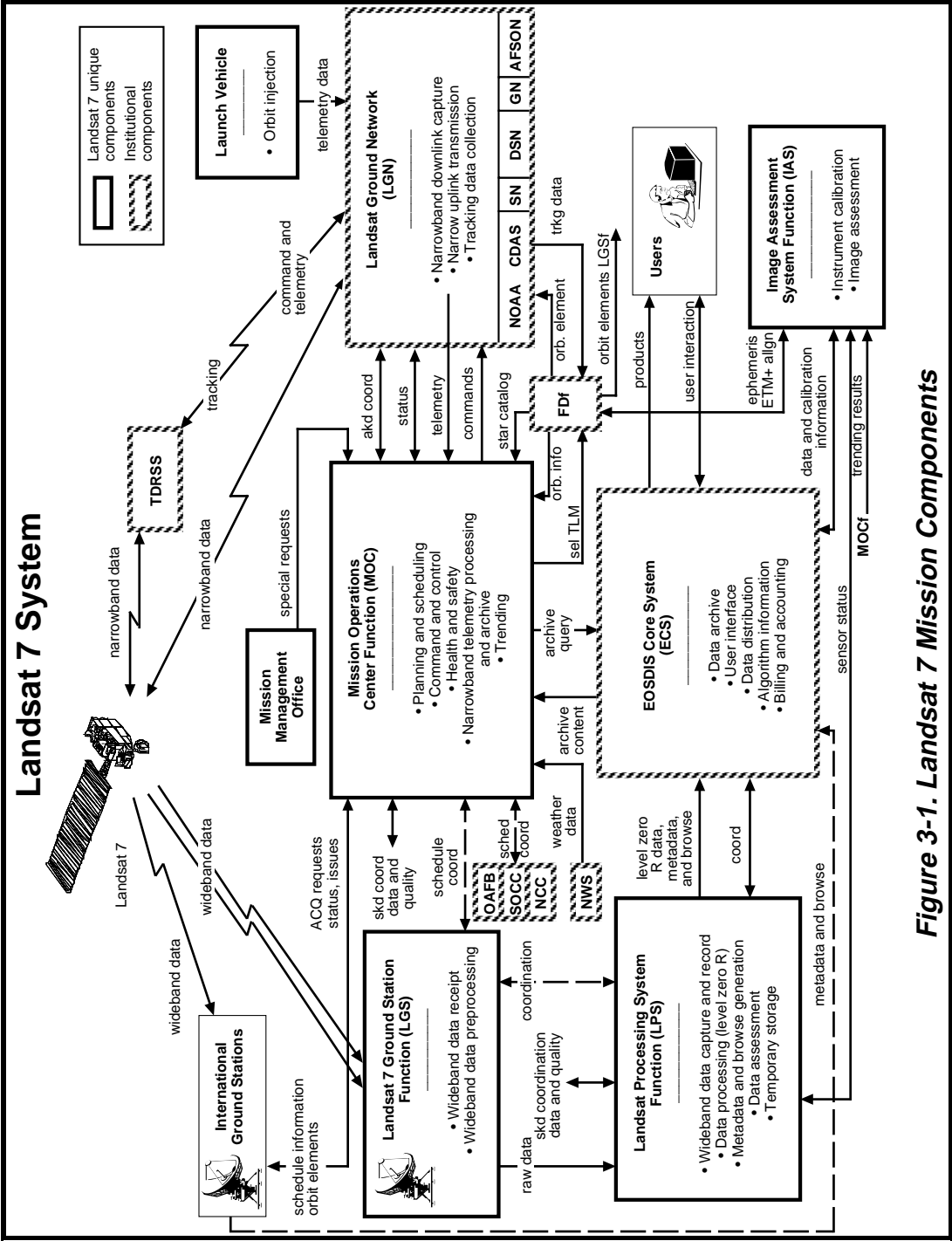


Figure 3-1. Landsat 7 Mission Components

3.3.2 Landsat 7 Mission Components

Figure 3-1 illustrates the Landsat 7 mission components which are described below. These include the Space Segment, Launch Segment and Ground Segment, and other management, program and institutional elements with a role in the Landsat 7 mission.

3.3.2.1 Landsat 7 Space Segment

The Space Segment includes the Landsat 7 satellite and the Aerospace Ground Equipment (AGE). The Landsat 7 satellite is a 5000 pound-class satellite designed to fly a 705 km, sun-synchronous, earth mapping orbit with a 16 day period. The Landsat 7 Satellite consists of a spacecraft bus and the ETM+ instrument. The ETM+ will provide data continuity with the previous Landsat satellites. The satellite has an onboard recorder for narrowband and wideband data. The AGE consists of all electrical, mechanical, instrument and propellant ground equipment and related software used to integrate and test the satellite, and integrate the satellite to the launch vehicle.

3.3.2.2 Landsat 7 Launch Segment

The Launch Segment is composed of a Delta II 7920-10 launch vehicle, launch site equipment and supporting services.

3.3.2.3 Mission Operations Center (MOC)

The MOC is responsible for satellite health and safety; it performs command, control and monitoring functions in support of this responsibility. The MOC also plans, schedules and commands the mission activities, including global archive refresh of cloud free images, satellite housekeeping and other mission requirements. The MOC, as an ECS user, receives Landsat 7 metadata containing cloud cover assessment to evaluate cloud coverage. The MOC will also provide engineering data, extracted from the Landsat spacecraft housekeeping data stream, to ECS daily for distribution.

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3.3.2.4 Ground Data Handling Segment (GDHS)

The Ground Data Handling Segment, located at EDC, is comprised of four main components which are:

- the Landsat 7 Ground Station which receives wideband data via the X-band downlink, preprocesses the data and forwards it to the Landsat 7 Processing System (LPS) for data capture.

- the LPS which captures the wideband data and generates Level 0R data including browse and metadata.

- the Image Assessment System (IAS) which is responsible for instrument calibration and image assessment.

- the information management and product archive and distribution components of ECS.

The LPS and the IAS are the GDHS components which interface with ECS. The LPS sends the Level 0R data, along with metadata and inventory data describing its products, to the co-located ECS. The IAS retrieves Level 0R data from the co-located ECS for off-line assessment of image quality. It also supplies calibration data and metadata updates to the ECS for archive and distribution. The IAS also provides guide updates and reports to the ECS document data server.

CH02

3.3.2.5 Mission Management Office (MMO)

The MMO provides the management function for the Landsat 7 system. The MMO receives policies and guidelines from the Landsat Coordination Group. The MMO implements these operational policies and guidelines through the establishment of general, specific and special rules of operation for the Landsat 7 system. ECS will receive cost information from the MMO and will provide statistics, reports and system status to the MMO.

CH04

3.3.2.6 International Ground Stations (IGSs)

The International Ground Stations receive ETM+ instrument data via direct downlink X-band transmissions. IGS acquisition requests are submitted directly to the MOC and routinely cover all land mass coverage within the station's field of view. The IGSs will periodically provide metadata and browse data for IGS holdings to the ECS component of the EDC DAAC.

3.3.2.7 Institutional Support

Flight Dynamics Facility (FDF) A NASA institutional facility, the FDF analyzes Landsat 7 flight dynamics and provides definitive and predictive ephemeris data and mission planning aids to the MOC. It also supports orbit maneuver planning and analysis.

NASA Communications (Nascom) This refers collectively to the circuits, switching, and terminal facilities established and operated by NASA to provide operational telecommunications support for all NASA projects.

Landsat 7 Ground Network (LGN) The LGN consists of the communications networks necessary to support S-band communications for the Landsat 7 mission. The components of the LGN include:

NOAA's Fairbanks and Wallops Command and Data Acquisition Stations (CDASs) for table load and telemetry playback services

Space Network (SN) for tracking and real-time command and telemetry services

Deep Space Network (DSN), Ground Network (GN), and Air Force Satellite Control Network (AFSCN) for emergency command and telemetry services

Network Control Center (NCC) for GN, DSN and SN scheduling services

NOAA Satellite Operations Control Center (SOCC) for CDAS scheduling services

Onizuka Air Force Base (OAFB) for AFSCN scheduling services

4. Data Flow Descriptions

4.1 Overview

The Landsat 7 satellite collects remotely sensed terrestrial data for governmental, academic, commercial, national security, and civilian users. The Landsat 7 System is a space/ground system providing a global landmass data archive refreshed on a periodic basis. As described in Section 4.2, metadata and browse data associated with global refresh are passed to ECS so users can search for available data. ECS receives, archives and distributes Landsat 7 data and provides the interface to the Landsat 7 user community, as described in section 4.3. Figure 4-1 shows the interface flows between the ECS and the Landsat 7 systems.

Table 4-1 provides an overview of the data flows between the ECS and the Landsat 7 system. This table lists the physical source and destination of each flow, the data flow name, a short description of the data flow, and the communications link supporting the interface. The operational context of each of these data flows is presented in the following sections.

4.2 Global Refresh

The Landsat 7 mission provides Level 0R data for archive by ECS. Level 0R data is a viewable image product with radiometric and geometric correction information appended, but not applied. The Landsat 7 MOC schedules and controls acquisition requests, independent of ECS, based on the need for periodic global coverage (global refresh). Once the data are captured and processed, the LPS passes the Level 0R data, Level 0R browse, and associated inventory metadata to the ECS for archive (Flows 1 and 2 in Figure 4-1). The MOC then receives metadata from ECS to evaluate cloud coverage and determine if acquisitions need to be repeated. The MOC interfaces to the ECS for product order and distribution are the same as that described in section 4.3 and shown in Fig 4-1 for Landsat 7 users.

Level 0R data, Level 0R browse, and associated inventory metadata are provided to ECS on a sub-interval basis. An interval, which may contain multiple subintervals, is the time duration between the start and stop of an imaging operation of the Landsat 7 ETM+ instrument. A subinterval is continuous instrument data within one Landsat 7 contact. Subintervals are caused by breaks in the wideband data stream due to communication dropouts and/or the inability of the spacecraft to transmit a complete observation within a single Landsat 7 contact period.

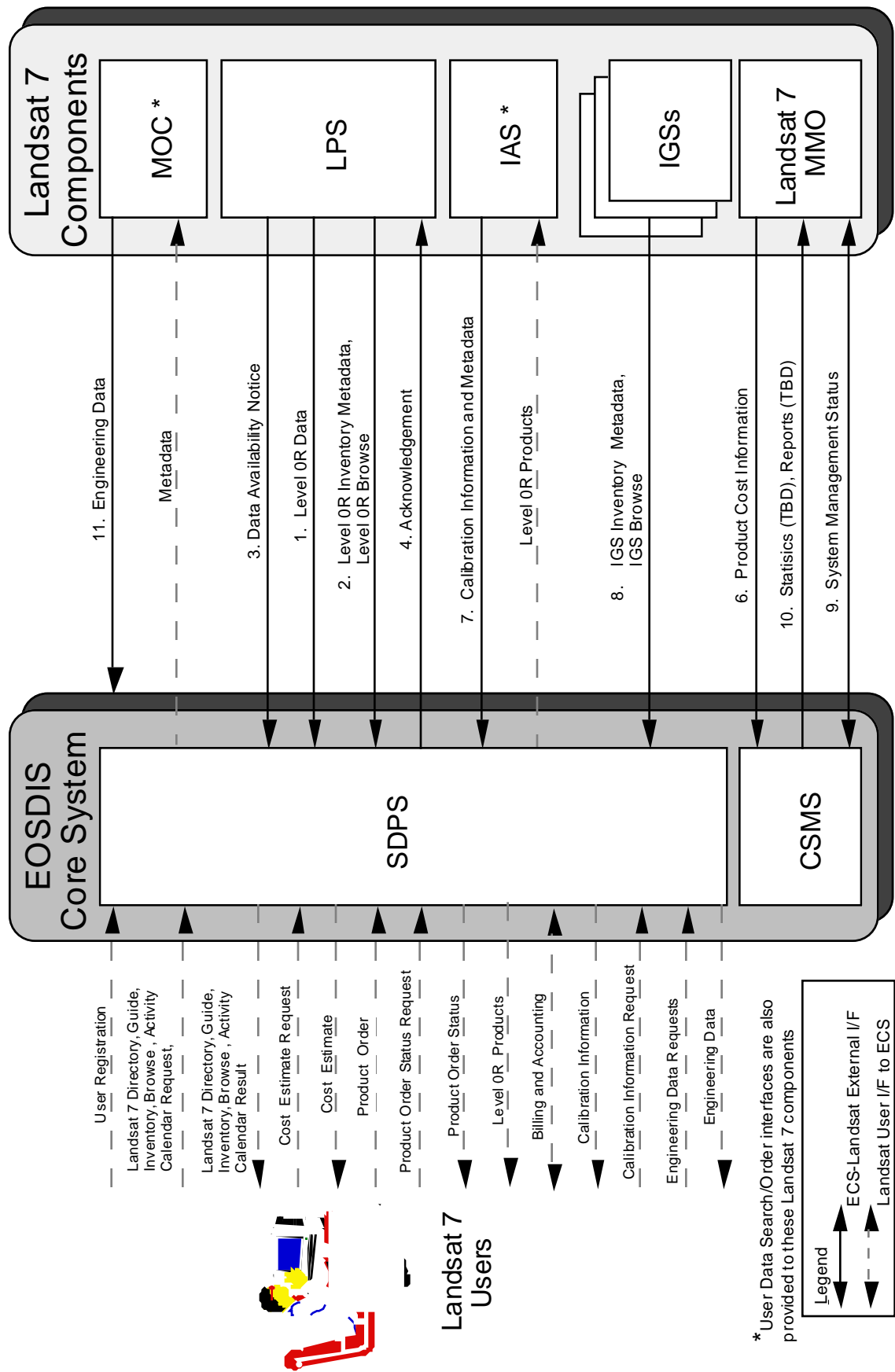


Figure 4-1. ECS/Landsat 7 Interface Flow Diagram

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The Landsat 7 150 Mbps wideband downlink is comprised of two 75 Mbps channels. Bands 1-6 are downlinked on one, and bands 6-8 on the other. The LPS will process this data, on a subinterval basis, in two distinct formats: Format 1 for bands 1-6 and Format 2 for bands 6-8. As a result, the LPS will provide ECS with the following Format 1 files per subinterval: six Level 0R instrument data files, one calibration file, one mirror scan correction file, one payload correction data (PCD) file, one metadata file, and one multiband (image from three predefined bands) browse image file. The equivalent types of files will be provided by the LPS in Format 2, except there will be three Level 0R instrument data files. Appendix A, Table A-1 identifies the current maximum daily data volumes for ECS ingest and archival of Landsat 7 data.

4.3 Data Transfer and Product Distribution

After the LPS completes processing of data, it notifies ECS that the data is available for transfer. The LPS provides the ECS with a data availability notice (Flow 3 in Figure 4-1) which identifies Level 0R data, associated inventory metadata and Level 0R browse available for pickup by the ECS. Subsequent to the receipt of the data availability notice and within 8 hours, ECS pulls the available data from the LPS and completes archival of the data. ECS will receive multiple files representing subintervals, one file per subinterval band/data type. The number of files archived depends on the number of subintervals acquired during each Landsat 7 contact period. The ECS sends an acknowledgment upon successful transfer of data from the LPS and archival within ECS (Flow 4 in Figure 4-1). After archival, the users will be able to search and order the data. Data will be made available to delivery services or mail within 24 hours of ordering; however electronic delivery may be faster.

All ECS registered users are permitted access to ECS held Landsat 7 Level 0R data and browse data. The identity of users and their requests remain confidential. Landsat 7 directory information and guide information, providing general Landsat data information helpful to users, will be developed by the project scientist and the EDC DAAC scientist and be placed in the Advertising Server and the Document Data Server at the EDC DAAC. A user may query the availability of Level 0R archive data, and view Level 0R browse images and Level 0R metadata through the ECS. Searches may be based on any combination of geographic location, time of image collection, spectral band, sun elevation angle, cloud cover, and Worldwide Reference System (WRS), and other parameters as defined through the Landsat 7 metadata. The WRS is a set of predefined grids related to orbit revisit, and are consistent for Landsat 4, 5, and 7. As a result of the query the user will receive inventory metadata that represents the queried data.

CH02

Once the data of interest are identified, users may order standard Level 0R products. Upon request, a user will receive a cost estimate of a potential Landsat 7 Level 0R data order. Product cost information provided to the ECS by the Landsat 7 MMO (Flow 6 Figure 4-1) will be used in assessing charges for user orders. In response to a product order, the ECS will distribute WRS scene data from the subinterval representing the data requested. As a result of user inquiry against a product order, the ECS provides product order status to the user.

The ECS distributes products electronically over communication networks or creates physical media in response to user orders. The ECS writes the physical media, packages, and distributes Landsat 7 products to requesters. Appendix A, Table A-2 identifies the current maximum daily data volumes for Landsat 7 product distribution.

Users will be able to order one or more scenes or a subinterval of scenes. Scenes can be identified by WRS or geographically by latitude and longitude. User product orders will include:

- All 9 Bands for a single scene (includes FM1 and FM2 band 6)
- Metadata
- PCD (2, 1 for each format) on a subinterval basis
- MSCD (2, 1 for each format) on a subinterval basis
- Calibration data on a scene basis
- Browse Image(s) (as received from LPS)
- Processing/Calibration Coefficients (IAS)

The distribution will be HDF however the Landsat standard format may also be ordered.

4.4 Image Assessment System Interface

The IAS receives up to 10 scenes per day of Level 0R data from ECS to support ETM+ instrument calibration and image assessment. Based on IAS analysis, calibration information and associated metadata are provided to ECS (Flow 7 in Figure 4-1). The IAS interface to ECS for product search, order and distribution is the same as that described in section 4.3 and shown in Figure 4-1 for a Landsat 7 user.

4.5 International Ground Station Interface

The Landsat 7 IGSs provide the ECS with inventory metadata and browse for IGS Landsat 7 data holdings (Flow 8 in Figure 4-1). ECS provides the capability for Landsat 7 users to search for these data. Landsat 7 users submit product orders for IGS held data directly to the IGS. The IGS delivers these products directly to the Landsat 7 user.

4.6 System Management Interface

To support the above flows, the ECS and the Landsat 7 system also exchange system management status (Flow 9 in Figure 4-1). The ECS also provides the MMO with statistics and reports (Flow

CH04

4.7 MOC Interface

The MOC will deliver to ECS, daily, engineering data extracted from the spacecraft housekeeping data stream. (Flow II in Fig. 4-1) ECS will archive the data and provide the capability for users to search and order this data independently or as part of scene or subinterval products.

CH05

Table 4-1. ECS/LANDSAT 7 Data Flows

From	To	Data Flow	Description	Communications Link	
ECS	MOC	Metadata	Landsat 7 metadata	Internet	
MOC	ECS	Engineering Data	Engineering data extracted daily from S/C housekeeping data stream	Internet	CH05
Landsat 7 Program	Advertising Server	Landsat 7 Directory	Directory related to Landsat 7	Advertising Server	CH02
Landsat 7 Program	Document Data Server	Landsat 7 Guide Information	Guide information related to Landsat 7.	Document Data Server	CH02
LPS	ECS	Level 0R Inventory Metadata	Inventory information related to Level 0R data.	EBnet Interface Equipment	CH01
LPS	ECS	Level 0R Browse	Browse data related to Level 0R data.	EBnet Interface Equipment	CH01
LPS	ECS	Level 0R Data	Landsat 7 Level 0R data.	EBnet Interface Equipment	CH01
LPS	ECS	Data Availability Notice	Notice that identifies Level 0R data that is available for retrieval by the ECS from the LPS.	EBnet Interface Equipment	CH01
ECS	LPS	Acknowledgment	Acknowledgment from the ECS that data available from the LPS was successfully transferred to the ECS and archived.	EBnet Interface Equipment4.6	CH01
ECS	MMO	Statistics & Reports	Statistics and reports.	Mail, Email, Internet or media.	CH04
ECS	MMO	System Management Status	Operational status of ECS.	Internet	
Landsat 7 MMO	ECS	System Management Status	Operational status of Landsat 7.	Internet	
Landsat 7 MMO	ECS	Product Cost Information	Cost of Landsat 7 products.	Internet	
ECS	IAS	Level 0R data	Up to 10 scenes per day of Level 0R data delivered to IAS as an ECS user.	EDC Exchange LAN	CH03
IAS	ECS	Calibration Information Metadata update	Data required to perform calibration of the ETM+ science data and to update the ECS metadata.	EDC Exchange LAN	CH03
IGSs	ECS	IGS Inventory Metadata	Inventory information related to IGS held Landsat 7 data .	media (tape or disk)	
IGSs	ECS	IGS Browse	Browse data related to IGS held Landsat 7 data.	media (tape or disk)	

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5. Functional and Performance Interface Requirements

5.1 Requirements Traceability

The functional and performance interface requirements identified in this document are traced to the *Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System*. Appendix B, Table B-1 of this document provides a listing of each IRD requirement by requirement number and an identification of its parent requirements as found in this document.

The following sections present the functional and performance interface requirements for the ECS to Landsat 7 interface.

5.2 Functional Interface Requirements

LAND-0015	The MOC shall have the capability to interface with ECS as a user to acquire Landsat 7 metadata via a standing order.	
LAND-0016	The MOC shall send and ECS shall receive engineering data.	CH05
LAND-0020	The ECS shall have the capability to provide access to the Landsat 7 directory.	CH02
LAND-0030	The LPS shall have the capability to send and the ECS shall have the capability to receive data availability notices for Landsat 7 Level 0R data, and associated inventory metadata and browse data.	
LAND-0040	The ECS shall have the capability to provide access to the Landsat 7 guide information.	
LAND-0050	The LPS shall have the capability to send and the ECS shall have the capability to receive inventory metadata for Landsat 7 Level 0R data.	
LAND-0060	The LPS shall have the capability to send and the ECS shall have the capability to receive browse data for Landsat 7 Level 0R data.	
LAND-0070	The LPS shall have the capability to send and the ECS shall have the capability to receive Landsat 7 Level 0R data.	
LAND-0080	The ECS shall have the capability to send and the LPS shall have the capability to receive a data transfer acknowledgment.	
LAND-0085	The ECS shall have the capability to send and the LPS shall have the capability to receive an acknowledgement after ECS archives the Landsat 7 data.	

LAND-0090	The IGSs shall have the capability to send and the ECS shall have the capability to receive inventory metadata for Landsat 7 IGS data.
LAND-0100	The IGSs shall have the capability to send and the ECS shall have the capability to receive browse data for Landsat 7 IGS data.
LAND-0110	The IAS shall have the capability to send and the ECS shall have the capability to receive Landsat 7 instrument (ETM+) calibration information and associated metadata.
LAND-0115	The IAS shall have the capability to interface with ECS as a user to acquire Landsat Level 0R data.
LAND-0120	The ECS shall have the capability to send and the MMO shall have the capability to receive system management status.
LAND-0125	The ECS shall have the capability to send and the MMO shall have the capability to receive statistics and reports.
LAND-0130	The MMO shall have the capability to send and the ECS shall have the capability to receive system management status.
LAND-0140	The MMO shall have the capability to send and the ECS shall have the capability to receive product cost information.
LAND-0150	All information exchanged between the Landsat 7 System and the ECS shall be provided in mutually agreed to formats.
LAND-0160	All information provided to the ECS by the IGSs shall be provided in mutually agreed to formats.
LAND-0170	ECS elements shall be capable of supporting end-to-end test and verification activities of the EOS program including pre-launch, satellite verification, and instrument verification and operational phases as they pertain to the Landsat 7/ECS interface.
LAND-0180	The ECS shall be capable of ingesting, storing and distributing data from LPS to support Landsat 7 for : <ul style="list-style-type: none"> a. Pre-launch checkout of instruments b. Development of initial calibration information.
LAND-0185	The ECS shall be capable of supporting interface testing, operations testing and acceptance testing with the LPS, IAS and MOC.

| CH04

5.3 Performance Interface Requirements

LAND-0201	The ECS shall be capable of ingesting and archiving and acknowledging Landsat 7 Level 0R data produced by LPS over 12 hours, within 8 hours from the time of receipt of the data availability notice from LPS.
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LAND-0210 The ECS shall begin normal distribution of stored Landsat 7 products, within 24 hours from the time of receipt of the product order.

5.4 Network Requirements

LAND-0220	The Landsat 7 LPS shall provide the FDDI connector(s) and cable for connection to the EBnet interface equipment at EDC, required to transmit and receive Landsat 7 data to and from ECS .	CH01
LAND-0222	The Landsat 7 IAS and ECS shall each provide their own interface equipment and cables for connection to the EDC Exchange LAN, required to interface the IAS to ECS.	CH03
LAND-0225	ECS shall interface to the EBnet-provided interface equipment at EDC required to transmit and receive Landsat 7 data to and from ECS.	CH01
LAND-0230	The ECS shall be capable of interfacing with the MMO and MOC via the Internet.	

5.5 Security Requirements

The systems and network involved in the Landsat 7 to ECS interface are required to meet the minimum requirements directed by the Computer Security Act of 1987, the Office of Management and Budget (OMB) Circular A-130 and NASA implementing directives NASA Management Instruction (NMI) 2410.7B and NASA Handbook (NHB) 2410.9A. The sensitivity of the ECS system has been determined to be Sensitivity Level 2.

LAND-0240 The interfaces and any systems connecting to the ECS through these interfaces shall be consistent and compatible with ESDIS implementation of all security requirements imposed on the ECS and with all security documents applicable to ECS.

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6. Interface Control Documentation Plan

The ICD planned which corresponds to this IRD will be entitled The Interface Control Document Between the EOSDIS Core System (ECS) and the Landsat 7 System. This ICD will define the functional and physical design of each interface between ECS and the Landsat 7 System, and will include the precise data contents and format of each interface. All modes (options) of data exchange for each interface will be described as well as the conditions required for each mode or option. Additionally, data rates, duty cycles, error conditions, and error handling procedures will be included. The sequence of exchanges will be completely described (e.g., required handshaking.) Communications protocols or physical media will be detailed for each interface. This ICD will be controlled by ESDIS Configuration Control. Development of this ICD is the responsibility of the ECS contractor.

The ECS to Landsat 7 interfaces are currently scheduled for final implementation in ECS Release B, with early interface testing of the major interfaces between the two systems in ECS Release A. To support this schedule, ECS will provide a final ICD on August 1, 1995 detailing the early interface testing interfaces two weeks prior to ECS Release A CDR. A preliminary version of this ICD will be prepared approximately two months in advance of the final Release A ICD (June 1995). A final ICD detailing all of the remaining ECS to Landsat 7 interfaces will be prepared two weeks prior to ECS Release B CDR (March 1996). Refer to the ECS Release Plan Content Description for details of ECS release planning including the identification of each ECS Release A and Release B Landsat 7 interface.

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Appendix A. Data Volumes

Table A-1 Landsat 7 Volume Estimates for Ingest and Archive

Data Types	Data Source	Data Destination	Flow (GB/Day)
Level 0R (image, metadata, browse)	LPS	ECS (EDC)	138
Calibration Information & Metadata	IAS	ECS (EDC)	.001
IGS Inventory Metadata, Browse	IGSs	ECS (EDC)	2
MOC Engineering data	MOC	ECS (EDC)	.001

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Table A-2 Landsat 7 Product Volume Distribution Estimates (GB/day)

Data Types	Data Source	Data Destination	Flow (GB/Day)
Level 0R Products	ECS (EDC)	Users	50
Level 0R Products	ECS (EDC)	IAS	5
Non-Image Product Components (Calibration Information, etc.)	ECS	Users	3

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Appendix B. Requirements Traceability

Table B-1 Requirements Traceability

<i>ECS/Landsat 7 IRD Requirement</i>	<i>Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System</i>	
LAND-0015	DADS 2370, EOSD 1720, EOSD 1740, ESN 0006, IMS 0670, IMS 0740	
LAND-0016	EOSD 1607, DADS 0470	CH05
LAND-0020	IMS 0356, IMS 0360, IMS 0380, IMS 0390	
LAND-0030	DADS 2020	
LAND-0040	EOSD 1607, IMS 0140, IMS 0415, IMS 0420	
LAND-0050	EOSD 1607, DADS 0470	
LAND-0060	EOSD 1607, EOSD 1608, DADS 0470	
LAND-0070	EOSD 1607, EOSD 1608, DADS 0470	
LAND-0080	DADS 1070	
LAND-0085	DADS 1070	
LAND-0090	EOSD 1607, DADS 0470	
LAND-0100	EOSD 1607, DADS 0470	
LAND-0110	EOSD 1607, DADS 0470, IMS 0230	
LAND-0115	DADS 2370, EOSD 1720, EOSD 1740, ESN 0006, IMS 0090	
LAND-0120	EOSD 1710	
LAND-0125	DADS 0890, SMC 8841, DADS 0927, IMS 1370, IMS 1680, IMS 1690, SMC 8920	
LAND-0130	EOSD 1710	
LAND-0140	EOSD 1608, SMC 1330	
LAND-0150	EOSD 1607	
LAND-0160	EOSD 1607	
LAND-0170	EOSD 0800	
LAND-0180	DADS 0281, EOSD 0510, EOSD 0800	
LAND-0185	EOSD 0760, EOSD 0510, EOSD 0750	
LAND-0201	EOSD 1085	
LAND-0210	DADS 2770	
LAND-0220	ESN 0010, ESN 0070	CH03
LAND-0222	ESN 0010, ESN 0070	CH03
LAND-0225	ESN 0010, ESN 0070	
LAND-0230	ESN 0006, ESN 1180	
LAND-0240	ESN 0600, EOSD 2100, ESN 1360	

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Abbreviations and Acronyms

AFSCN	Air Force Satellite Control Network
AGE	Aerospace Ground Equipment
CCB	Configuration Control Board
CDAS	Command and Data Acquisition Station
CDRL	Contract Data Requirements List
CSMS	Communications and System Management Segment
DAAC	Distributed Active Archive Center
DID	Data Item Description
DOI	Department of the Interior
DSN	Deep Space Network
ECOM	EOS Communications
ECS	EOSDIS Core System
EDC	EROS Data Center
EDOS	EOS Data and Operations System
EOS	Earth Observing System
EOC	EOS Operations Center
EOSDIS	Earth Observing System Data and Information System
EROS	Earth Resources Observation System
ESDIS	Earth Science Data and Information System
ESN	EOSDIS Science Network
ETM+	Enhanced Thematic Mapper Plus
FDF	Flight Dynamics Facility
FOS	Flight Operations Segment
GDHS	Ground Data Handling Segment
GN	Ground Network
GSFC	Goddard Space Flight Center

IAS	Image Assessment System
ICD	Interface Control Document
IGS	International Ground Station
IPA	Inter-Project Agreement
IRD	Interface Requirements Document
IST	Instrument Support Terminal
LGN	Landsat Ground Network
LPS	Landsat 7 Processing System
MOC	Mission Operations Center
NASA	National Aeronautics and Space Administration
NCC	Network Control Center
NOAA	National Oceanic and Atmospheric Administration
PSCN	Program Support Communications Network
SDPS	Science Data Processing Segment
SMC	System Management Center
SN	Space Network
TBD	To Be Determined
TBR	To Be Resolved
TBS	To Be Supplied
USGS	U.S. Geological Survey
WRS	Worldwide Reference System